DJ International – Pure Sip™ Personal Water Purifier

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Device Information

The DJ International Pure Sip Personal Water Purifier is a portable straw water treatment device. The device consists of a cigar size plastic straw with pull open mouthpiece, three cyst filter discs and end caps for each end of the straw. The device incorporates filtration and disinfection through the use of, in order of flow direction, filter (unknown material and pore size), iodinated resin (34 gr.), filter disc (material and pore size not stated), granular activated carbon (4.5 gr.), and 3 µm cyst filter (material not stated, testing data received claims 1 µm pore size). The device is used by inserting one of three supplied cyst filters into the mouthpiece cap, then simply placing the bottom of the straw into water and pulling water through straw by mouth suction. The manufacturer recommends discharging the first two mouthfuls of water to purge carbon fines. Device instruction state that device life is determined by the length of time and periods of use required for the filters to become clogged. The cyst filter should be replaced when suction through the unit becomes difficult. After the three cyst filters are used the instruction state to discard device. The manufacturer claims that a safety feature exists whereby the "capacity to purify and disinfect the water is greater than the filtering capacity of each purifier. The filter will clog before the purifying capacity of the unit is exhausted." The activated carbon should reduce taste and odor of the source water as well as at least some of the residual iodine taste and odor imparted by the resin. This device is assigned the GSA# GS-07F-0167K under the company DJ International. The manufacturer has applied for but not been issued an NSN#. This device is produced by Water One, Inc., and distributed by DJ International. It is unclear which company holds the trademark registration for this device.

Effectiveness Against Microbial Pathogens

Several laboratory reports (reference 1) were received testing this device to modified versions of the U.S. Environmental Protection Agency (USEPA) Guide Standard and Protocol for Testing Microbiological Water Purifiers (reference 2). Independent data showed this device capable of reducing bacteria concentrations by > 6-log, however, only out to a volume of 10 L. No testing data received tested this device beyond the 10 L capacity. Bacterial reductions did not meet the requirements of reference 2 after the stagnation periods required in the protocol. This indicates substantial regrowth of bacteria within the unit. Independent testing on cyst reduction using

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3-4 µm latex spheres showed just over 2-log reduction testing only to a volume of just over 2 L. The laboratory report indicates the possibility of bypass through the unit. Viral reduction testing was performed several times by different independent laboratories. Results show that this device is not capable of meeting the > 4-log reduction, as required in reference 2. The elevated turbidity stage of the testing proved difficult for the device to meet the requirements, with multiple filter changes required to produce the proposed 10 L volume. No testing was performed out to the manufacturer estimated volume of the device. An important finding from this testing is the concentration of residual iodine in the effluent water. Results show up to 11 mg/L in the effluent water indicating little reduction by the activated carbon and concern for users susceptible to iodine. Test results and general knowledge of filtration and iodinated resin (references 3 and 4) indicates that this device would likely be able to reduce bacteria by > 6-log, and would not meet the requirements for *Giardia* cysts (3-log), *Cryptosporidium* oocysts (3-log), or viruses (4-log). This device is not expected to meet these requirements out to the manufacturer stated capacity due to premature clogging in turbid waters. Based on this information the DJ International Pure Sip Personal Water Purifier is assigned one √ for bacteria, and one X each for *Giardia* cysts, *Cryptosporidium* oocysts, and viruses (for an explanation of the rating checks click here). The following table summarizes the device's expected effectiveness against microbial pathogens, evaluation rating, and the mechanism by which pathogens are removed or inactivated:

Table. Expected Performance Against Microbial Pathogens when Used as Directed.

Microbial Pathogen Type	Expected Performance	Evaluation Rating	Inactivation/removal Mechanism
Bacteria	> 6-log	√	iodine disinfection
Viruses	> 4-log	**X**	-
Giardia cysts	not effective	**X**	-
Cryptosporidium oocysts	not effective	**X**	-

Production Rate and Capacity

Inherent to the production rate and capacity of filtration devices is the quality of the raw water source. The actual production rate and capacity is dependent on the user and raw water quality. During testing of this device the production rate was targeted at 65 - 70 mL/min. The stated capacity is 35 - 115 L.

Cleaning, Replacement, End of Life Indicator

When suction by mouth becomes difficult the cyst filter should be changed. After the third cyst filter is clogged the device is to be discarded. The device is not capable of being cleaned or backwashed. Instructions recommend discarding the first two mouthfuls of water during the first use to remove carbon fines. This device contains no end of life indicator short of clogging. The manufacturer stated shelf life is up to 3 years. No expiration date or date of production is stated on the device or packaging.

Weight and Size

The dry weight of the device is stated by the manufacturer to be 100 grams. Dimensions are 3 cm diameter x 16 cm length.

Cost

The Pur Sip Straw costs $10.80 with a minimum order of 50 units. This device has not received registration as a biocide by the USEPA and is therefore not permitted to be sold within the United States. The manufacturer claims continued distribution to military organizations.

Device Evaluation

Based on evaluation of available data, the DJ International Pure Sip Personal Water Purifier is expected to provide 6-log bacteria under most water quality conditions expected until the unit clogs. This device will not consistently provide a 3-log *Giardia* cyst, 3-log *Cryptosporidium* oocyst, or 4-log virus reduction or inactivation. Additional treatment is required meet the requirements of the USEPA Guide Standard (reference 2). Iodine resin disinfection is the primary mechanism of bacteria inactivation. The iodine resin inactivates bacteria, viruses, and some *Giardia* cysts through direct contact with the resin as well as through the iodine residual the resin imparts to the water. The device will also provide some filtration and adsorption of all relevant pathogens due to the granular activated carbon and cyst filter disc. This device contains no indicator of process failure on a real-time basis and the end of device useful life is based on filter clogging. The manufacturer claims filter clogging prior to exhaustion of the iodinated resin. Inherent to treatment devices using filtration is the likelihood of clogging when processing highly turbid raw water. As seen in the laboratory testing results, this device is highly susceptible to clogging from particulate matter. If this device is used with water containing even slight cloudiness, it is not expected that this device will meet the manufacturer stated production capacity of 35 - 115 L. Based on data received, there is the possibility of a significant iodine residual in the consumed water, despite the post-resin activated carbon. The iodine resin and

residual are not expected to cause any adverse health effects to healthy adults with no pre-existing thyroid conditions or sensitivity to iodine. This device is not recommended for use by pregnant women (concern for fetus), people with known hypersensitivity to iodine, people with a history (or family history) of thyroid disease, and people from areas with chronic iodine deficiency (reference 3). The iodine residual imparted by the resin can cause a medicinal taste and color the water. Since the water is consumed directly from the device, neutralizers and flavor aids cannot be used to mask the iodine taste. This device is not approved by the USEPA for sale in the United States as a biocide and therefore must be purchased outside of the U.S. The manufacturer claims distribution to military organizations but this has not been verified.

Advantages

- Independent testing using a modified USEPA Protocol suggests that this device will provide 6-log bacteria inactivation when treating most water quality conditions expected.
- Small and lightweight.
- Simple to use.
- No adverse health effects expected in healthy adults with no iodine sensitivity.

Disadvantages

- Not effective against virus, *Giardia*, or *Cryptosporidium*. Additional treatment is necessary.
- Not recommended for use by pregnant women or people with iodine sensitivity.
- Device cannot be backwashed. Reduced production capacity in turbid waters.
- Can impart color and medicinal taste.
- No real-time indicator of process failure.

References

1. Laboratory challenge data obtained from the manufacturer.

2. USEPA, Registration Division Office of Pesticide Program, Criteria and Standards Division Office of Drinking Water. (1987). *Guide Standard and Protocol for Testing Microbiological Water Purifiers.* Washington, D.C.

3. U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM). (2005). *Technical Information Paper; Iodine Disinfection in the Use of Individual Water Purification Devices,* Aberdeen Proving Ground, MD.

4. USACHPPM. (2005). *Technical Information Paper; Filtration in the Use of Individual Water Purification Devices,* Aberdeen Proving Ground, MD.